

REMARKS

In view of the above amendments and the following remarks, reconsideration of the rejections and further examination are requested. Upon entry of this amendment, the specification is amended, the abstract is amended, claims 1-3 are amended, and claims 4 and 8 are cancelled, leaving claims 1-3 and 5-7 pending with claim 1 being independent. No new matter has been added.

The amendments are supported by the original specification at least in paragraphs [0004], [0009] and [0013] of the original specification, and Fig. 3B of the accompanying drawings.

Specification

The specification and abstract have been carefully reviewed and revised to correct grammatical and idiomatic errors in order to aid the Examiner in further consideration of the application. No new matter has been added.

Rejections Under 35 U.S.C. §102(b)

Claims 1-3 and 5-7 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Tanaka et al. (JP 3-260415).

Applicants submit that the claims as now pending are allowable over the cited prior art. Specifically, amended independent claim 1 now recites a fluid dynamic bearing apparatus comprising a hydrodynamic groove region including first and second roll-over portions, the roll-over portions being generated when the hydrodynamic groove region is formed by thrusting a pattern corresponding to the shape of the hydrodynamic groove region so as to carry out plastic processing at first and second ends of the hydrodynamic groove region, and a smooth surface defined by a step so as to have a length shorter than a length of the hydrodynamic groove region so that the smooth surface opposes the hydrodynamic groove region except at the first and second roll-over portions of the hydrodynamic groove region.

Thus, the present invention, as recited in independent claim 1, is directed to a smooth surface having a step that is opposed to a hydrodynamic groove region except at roll-over portions at both ends of the hydrodynamic groove region, and a bearing gap is disposed between the entire region of the smooth surface and the land portion of the hydrodynamic groove region. According to this structure, the bearing gap can have a substantially constant dimension

throughout its region. The structure recited in claim 1 is further advantageous in that the hydrodynamic groove can have a substantially constant depth and can be selectively included in the bearing gap, because the hydrodynamic groove, in a part of the hydrodynamic groove region where the roll-over portions are formed, is outside of the region opposing the smooth surface. Accordingly, the combination of the bearing gap having a constant dimension and the hydrodynamic groove exerts a synergetic effect, achieving a very high hydrodynamic effect, and the high hydrodynamic effect consequently produces high bearing rigidity.

Moreover, the recited structure enables the dimension of the bearing gap (e.g., the gap width) and the depth of the hydrodynamic groove included in the bearing gap to be substantially constant, such that failure of expected bearing rigidity is avoided by simply designing the lengths of the smooth surface and the hydrodynamic groove region (e.g., the axial dimension and width-direction dimension) to have predetermined dimensions.

The structure, as recited in claim 1 of the present application, further includes roll-over portions formed at the end portions of the hydrodynamic groove region that are opposed to portions of the bearing apparatus other than the smooth surface (i.e., portions adjacent to the smooth surface). As a result, the gap width in the roll-over portions can be larger than the constant bearing gap. This structure enables removal of the region, which does not significantly improve the hydrodynamic effect but rather invites an increase of the fluid resistance, from the bearing gap, thereby minimizing a possible increase of the torque due to the fluid resistance.

The structure of the invention recited in claim 1 of the present invention has such distinctly advantageous effects, since the structure provides a fluid dynamic bearing apparatus capable of achieving a high hydrodynamic effect and a high bearing rigidity by fully utilizing the hydrodynamic groove region while avoiding an increase in the rotational torque.

The cited prior art fails to disclose or render obvious such an apparatus. In particular, Tanaka discloses a fluid dynamic bearing apparatus having radial receiving surfaces 5 that are longitudinally distant from each other and are formed in an outer periphery of a shaft 3A, and asymmetrical grooves for generating a fluid dynamic pressure (herringbone grooves) 7 formed in the radial receiving surfaces 5 (Fig. 3). The axial length 1 of the groove 7 for generating fluid dynamic pressure is larger than the axial length L of a radial bearing surface 4 provided in an inner periphery of sleeve 36 in which the shaft 3A is inserted (Fig. 4).

Thus, Applicants submit that it is clear that Tanaka fails to disclose the roll-over portions

recited in claim 1 of the present invention. In particular, Tanaka discloses that the fluid dynamic bearing apparatus includes an axial end portion of the groove 7 for generating a fluid dynamic pressure that is opposed to an axial end portion of the radial bearing surface 4. *See* Fig. 4. In other words, the end portion of the hydrodynamic groove 7 remains disposed in the radial bearing gap. As would have been clear to one of ordinary skill in the art, such a structure clearly lacks the recited roll-over portions.

Moreover, there is no reasoning in the prior art to modify Tanaka, such that it would have rendered independent claim 1 obvious. Any such reasoning would have involved improper hindsight. Therefore, Applicants submit that independent claim 1 and its dependent claims are allowable over the cited prior art.

Furthermore, Applicants submit that combining Tanaka with Shiranami does not render independent claim 1 obvious. The Examiner states that Shiranami discloses a region in which a hydrodynamic groove 1c and another region (smooth region 1d, land 1e) are formed by plastic processing using thrusting pattern 3a (Fig. 5). Applicants submit that even assuming *arguendo* that Shiranami discloses this subject matter, Shiranami clearly does not disclose that the hydrodynamic groove region includes first and second roll-over portions that are formed at first and second ends of the hydrodynamic groove region when the hydrodynamic groove region is formed, as recited in claim 1 of the present application. Therefore, Applicants submit that Shiranami fails to also disclose a smooth surface defined by a step so as to have a length shorter than a length of the hydrodynamic groove region so that the smooth surface is opposed to the hydrodynamic groove region except at the first and second roll-over portions of the hydrodynamic groove region, as recited by claim 1 of the present application.

Moreover, there is no reasoning in the prior art to modify Tanaka or Shiranami, such that the combination thereof would have rendered independent claim 1 obvious. Any such reasoning would have involved improper hindsight. Therefore, Applicants submit that independent claim 1 and its dependent claims are allowable over the cited prior art.

Rejections Under 35 U.S.C. §103(a)

Claims 4 and 8 have been rejected under 35 U.S.C. 102(b) as being anticipated by Tanaka or in the alternative, under 35 U.S.C. §103(a) as being obvious over Tanaka in view of Shiranami et al. (JP 11-190344).

This rejection is moot, since claims 4 and 8 have been cancelled.

Conclusion

In view of the foregoing amendments and remarks, all of the claims now pending in this application are believed to be in condition for allowance. Reconsideration and favorable action are respectfully solicited.

Should the Examiner believe there are any remaining issues that must be resolved before this application can be allowed, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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